

## **Appendix D: Drivers and Stressors and Related Plan Components**

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## Introduction

One of the goals of the revised plan is to maintain or restore ecological integrity; the quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence (36 CFR 219.19).

Drivers and stressors are factors that may directly or indirectly affect ecological integrity. The Flathead National Forest considered conditions, trends, drivers or stressors identified in the *Assessment of the Flathead National Forest*<sup>1</sup> related to the need to change the plan components (§ 219.6). Tables D-1 and D-2 provide a cross-walk of the primary plan components that would address those drivers or stressors and their anticipated effects on key ecosystem characteristics or aquatic and terrestrial species. Appendix A provides a more extensive listing of species associated with the riparian, wetland, and aquatic habitats discussed in tables D-1 and D-2.

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<sup>1</sup> USDA, Forest Service. 2014. Assessment of the Flathead National Forest. Available online at [www.fs.usda.gov/goto/flathead/fpr](http://www.fs.usda.gov/goto/flathead/fpr).

Table D-1. Drivers and stressors of aquatic ecosystems and species

Primary Drivers and Stressors	Potential Effects to All Aquatic Species	Plan Components Addressing Driver or Stressor
<b>Climate Change</b>	Climate change may result in a warming climate that elevates water temperatures, changes the timing of rain events and spring run-off and alters flow regimes. Elevated temperatures favor non-native rainbow and brook trout.	FW-DC-WTR 01, 03, 04 FW-DC-AQH 01
<b>Fire</b>	Fire has a highly variable effect on aquatic resources. Fire may increase water temperatures if riparian areas burn severely and may contribute large amounts of sediment to streams from erosion. Conversely, fires can be extremely beneficial and increase nutrients in nutrient poor aquatic environments and also increase large amounts of beneficial wood to streams.	FW-DC-FIRE-01 FW-DC-FIRE-03 FW-DC-FIRE-04 FW-STD-FIRE-01
<b>Flooding</b>	Some streams on the Flathead National Forest are still recovering from the 1964 flood. Flooding can scour and simplify stream habitats at extremes but regular flooding can be highly beneficial by reclaiming floodplains and establishing new vegetation.	FW-DC-WTR 01, 03, 04, 10
<b>Forest Insects and Disease</b>	In general, insect and disease outbreaks are beneficial for aquatic environments by providing dead trees that are recruited to the stream network. If epidemic levels of insects or disease kill trees in riparian areas it could lead to high intensity, high severity fires which could have detrimental effects to aquatic species, for example, by reducing stream shading.	FW-DC-WTR 01,04, 10, 11 FW-DC-RHCA 1-6
<b>Human Land Uses and Development</b>	Land uses, primary road networks, tend to have negative effects to aquatic habitats. Culvert barriers and elevated sediment levels both restrain fish populations. Dams also fall into this category and create barriers for fish passage. However, the barriers dams create can have beneficial effects, for example by preventing upstream migration of non-native species (e.g., lake trout and Hungry Horse dam).	FW-GDL-WTR 01-05 FW-GDL-RHCA 01-11
<b>Invasive Species</b>	Invasive species are perhaps the single greatest threat to aquatic resources. Non-native lake trout in Swan and Flathead lakes have impacted native fish populations, rainbow trout have hybridized with pure cutthroat populations and brook trout have outcompeted and hybridized with native fish populations. Invasion by New Zealand mud snails and quagga mussels are potential threats.	FW-DC-AQS 01-05
<b>Vegetation Treatments</b>	Vegetation treatments themselves have had little effects on aquatic habitats; historically elevated water yields led to in-channel erosion but this effect is rarely seen today on the Forest's watersheds. The associated road networks that support the treatments tend to have more of an effect by elevating sediment levels.	FW-DC-RHCA 01-06 FW-GDL-RHCA 01-11
<b>Drought</b>	Drought plays a critical role in that sediments are not flushed from stream systems. Low flows can cause an armoring of the streambed and make it difficult for redd construction or fry emergence for salmonids.	FW-GDL-AQS 01 FW-DC-WTR 03, 04, 09
<b>Avalanches</b>	Avalanches can deliver large amounts of sediment into stream networks but also provide large amounts of beneficial wood.	FW-DC-WTR 03, 04, 11

<b>Primary Drivers and Stressors</b>	<b>Potential Effects to All Aquatic Species</b>	<b>Plan Components Addressing Driver or Stressor</b>
<b>Cattle Grazing</b>	Grazing can cause long-term negative effects to aquatic habitats through bank trampling and reduction of streamside vegetation.	FW-GDL-ECOS GR 04, 04

Table D-2. Drivers and stressors of terrestrial ecosystems and species

<b>Primary Drivers and Stressors</b>	<b>Potential Effects to Wildlife Threatened and Endangered, Species of Conservation Concern, and Species of Public Interest</b>	<b>Plan Components Addressing Driver or Stressor</b>
<b>Climate Change–Snowpack</b>	Climate change may result in reduced acreage with persistent spring snow—there is a high level of uncertainty associated with expected winter changes to climate in northwest Montana. Loss of persistent spring snow may reduce habitat available for associated species such as the wolverine, White-tailed Ptarmigan, Grey-crowned Rosy-finch, and Hoary marmot.	FW-DC-SOPI-WL-01 FW-GDL-SOPI-WL-02,03
<b>Climate Change–Drought</b>	Black swifts nest behind waterfalls. Waterfalls may dry up sooner or altogether if the frequency or severity of droughts increases, reducing available nesting habitat. Boreal toads breed in ponds and shallow lake margins. Ponds may dry up sooner or altogether if the frequency or severity of droughts increases, reducing available breeding habitat. Changes in water levels may result in loss of peatlands, reducing habitat or habitat connectivity for associated species such as the Northern Bog Lemming.	FW-DC-WTR-01 through 04,06,09,10,11 FW-DC-WET-01 through 07 FW-DC-RHCA-01
<b>Climate Change–Avalanches</b>	Avalanches are a natural ecosystem process. They may increase or decrease with changes in climate. There is a high level of uncertainty associated with expected winter changes to climate in northwest Montana. Avalanche chutes provide food and cover for species such as the grizzly bear throughout the non-denning season. Wolverines may feed on carcasses of animals found in avalanche chutes. Many avalanche areas are in wilderness or proposed wilderness where natural ecosystem processes prevail.	MA-1a-DC-03 MA-1b-DC-02
<b>Climate Change–Wildfires</b>	Climate change may result in increased acreage and/or severity of wildfires. Moose, Elk, Black-backed woodpecker, Olive-sided flycatcher, Cassin's finch, and other species associated with burned habitats or earlier successional forest may benefit from increases in wildfires.  Fisher, Canada lynx, marten and other species associated with forest cover may have reductions in available habitat and/or habitat connectivity for a period of about 20 years or more until forested stands recover.	FW-DC-RHCA-05,
<b>Climate Change–Frequency or Severity of Floods</b>	Regular flooding may be beneficial by reclaiming floodplains, promoting regeneration of cottonwood trees, and establishing new shrubs, providing habitat for the veery and other species associated with riparian, wetland, or aquatic habitats. However, if flooding becomes more extreme, more frequent, or if it occurs later in the spring, it may have detrimental effects. Harlequin ducks nest on log jams or densely vegetated shorelines of clear, fast-moving streams. If the frequency or severity of floods increases, it could result in higher levels of nest failure and harlequins do not typically re-nest. Common loons nest on islands in lakes or on the shoreline of lakes. If the frequency or severity of floods increases, it could result in higher levels of nest failure	FW-DC-WTR-01 through 04,06,09,10,11 FW-DC-WET-01 through 07 FW-DC-RHCA-01,02

Primary Drivers and Stressors	Potential Effects to Wildlife Threatened and Endangered, Species of Conservation Concern, and Species of Public Interest	Plan Components Addressing Driver or Stressor
	and loons may or may not re-nest.	
<b>Change in Aquatic, Wetland or Riparian Habitat Quality and/or Quantity</b>	Species such as the Great blue heron, Common loon, Harlequin duck, Boreal Toad, Townsend's big-eared bat, and Bald eagle breed and/or feed in or near lakes, ponds, rivers or wetlands. Poisoning of non-desirable fish species, filling of wetlands, accumulation of lead shot or pesticides may reduce or contaminate their food supply. Lead accumulation may also cause direct mortality. Changes in water flows or chemistry may affect peatlands. Loss of very large cottonwood trees used for nesting by bald eagles and for communal nesting by Great blue herons may also result in decreased reproductive success. Removal of beavers may cause reductions in the quantity or quality of riparian, wetland, or aquatic habitats for many wildlife species.	FW-DC-RHCA-03, 05,06 FW-DC-WET-05 FW-STD-RHCA-01 FW-GDL-RHCA-01 through 05,08,09,10 FW-DC-AQH-01,02 FW-OBJ-AQH-01,02 FW-DC-AQS-01,03,06,07 FW-GDL-AQS-02
<b>Forest Insects and Disease</b>	<p>The primary insect on the Flathead National Forest is Mountain pine beetle, affecting whitebark pine, lodgepole pine, and ponderosa pine. Root diseases are widespread, affecting mainly Douglas-fir and true firs (<i>Abies</i> spp). Blister rust is an introduced disease that severely impacts western white pine and whitebark pine.</p> <p>Pileated woodpeckers, Flammulated owls, Black-backed woodpeckers, and other cavity nesting species may benefit by insects and diseases that create snags suitable for nesting and feeding. Epidemic levels of insect or disease may reduce result in loss of old growth stand structure needed by associated species. The loss of cone-producing whitebark pine trees has reduced the summer food supply for Clark's nutcrackers, a species which has a mutualistic relationship with whitebark pine. Spruce budworm may kill small spruce and sub-alpine fir trees, reducing understory tree density in lynx habitat. Insect and disease infestations may become more extreme during drought conditions.</p>	FW-DC-TE&V-11,12,18 FW-DC-ECOS TIMB MA-1a-DC-03 MA-1b-DC-02
<b>Terrestrial Invasive Species</b>	Invasive plant species may out-compete native forage plants and most wildlife species do not eat invasive plants. Warmer temperatures, associated drier conditions, and more severe or frequent droughts, may provide more opportunities for invasive plants to gain an advantage over native species, as invasive species are well adapted to using resources and reproducing quickly. Species with the greatest potential to be affected by invasive plants are those associated with grass-forb-shrub communities.	FW-GDL-RHCA-04 FW-DC-TE&V-06 FW-GDL-TE&V-04 MA-3 Special Area-DC-02 MA-1a-DC-04
<b>Human Land Uses–Vegetation Treatments</b>	Forest succession moves forests from early to late successional stages, changing the forest composition, structure and pattern over long periods of time. Vegetation treatments (e.g., timber harvest, pre-commercial thinning, fuels reduction, prescribed fire, and planting) alter forest composition, structure, processes, and patterns. Treatments may have beneficial, benign, or detrimental effects depending upon the animal species and whether treatments are moving forests towards desired ecosystem conditions or not.	FW-DC-RHCA-03, 05,06 FW-OBJ-RHCA-01 FW-STD-RHCA-01 FW-DC-WET-07 FW-DC-TE&V-01 through 06, 08 through 23 FW-OBJ-TE&V-01,02,03 FW-STD-TE&V-01 through 06

Primary Drivers and Stressors	Potential Effects to Wildlife Threatened and Endangered, Species of Conservation Concern, and Species of Public Interest	Plan Components Addressing Driver or Stressor
		FW-GDL-TE&V-01 through 14 FW-OBJ-SCC-WL-02 FW-GDL-SCC WL-02,04 FW-DC-SOPI-WL-01,02,03 FW-GDL-SOPI-WL-01 FW-DC-FIRE-03,04 FW-STD-FIRE-01,02,03 FW-GDL-FIRE-01 through 04
<b>Human Land Uses and Development—Open Road Network</b>	Open roads may result in seasonal loss of habitat security for species such as grizzly bears, black bears, gray wolves, mule deer, white-tailed deer, elk, and moose. Species associated with snags and down logs (e.g., pileated woodpecker, bald eagle, flammulated owl, marten, and fisher) may lose large snags or down logs used for cavity-nesting or denning in areas with open roads. Highways may result in reduced habitat connectivity and increased mortality of some wildlife species. Carinate mountainsnails may be affected by weed spraying on talus slopes adjacent to roads, or crushing of talus rock for gravel to maintain roads.	FW-GDL-RHCA-08,10 FW-GDL-SOIL-10 FW-GDL-TE&V-07 FW-DC-SCC WL-01 FW-OBJ-SCC-WL-02 FW-DC-SREC-02,03 FW-DC-IFS-05 FW-OBJ-IFS-01 FW-STD-IFS-01 through 04 FW-GDL-IFS-01 through 07,09,10 GA-SM-DC-01 GA-SM-STD-01 MA6c-DC
<b>Human Land Uses and Development—Cities, Towns, Developments, and Broad Expanses of Unforested Land</b>	Great gray owls, elk, white-tailed deer, and bald eagles are known to feed in agricultural areas. Birds such as bald eagles may be killed by ingesting poisons or lead shot used to control ground squirrels or other predators. Cities, towns, and broad expanses of un-forested lands may reduce habitat connectivity for species such as the Canada lynx, wolverine, or fisher.	FW-DC-LSU-01 FW-STD-ECOS E&M-05 through 08 FW-GDL-ECOS E&M-03,04 FW-STD-ECOS E&M-01 through 07 MA7-GDL-01 GA-HH-DC-12 GA-MF-DC-06 GA-NF-DC-10,11 GA-SM-DC-14 GA-SV-DC-11

Primary Drivers and Stressors	Potential Effects to Wildlife Threatened and Endangered, Species of Conservation Concern, and Species of Public Interest	Plan Components Addressing Driver or Stressor
<b>Human Land Uses and Development–Human Activities (e.g., boating, fishing)</b>	Common loons, Bald eagles and Peregrine falcons may be disturbed by some human activities close to their nests during the nesting season, which may result in lower productivity and/or chick survival.	FW-DC-SCC WL-01 FW-OBJ-SCC-WL-01 FW-GDL-SCC WL-03,04 FW-DC-SOPI-WL-01, 02,03
<b>Human Land Uses–Caves, Old Mines and Buildings; Bridges</b>	Townsend's big-eared bats use caves as maternity roosts and hibernacula. Recreational caving may introduce diseases such as white-nose syndrome. Closure of caves, old mines or buildings, or removal of bridges used by bats can make breeding, over-wintering and/or roosting habitat less available to bats.	FW-DC-SCC WL-01 FW-GDL-SCC WL-01
<b>Human Uses–Hunting and Trapping</b>	Species such as moose, gray wolf, beaver, marten, fisher, mule deer, white-tailed deer, mountain goat are hunted or trapped under regulated seasons managed by Montana Fish, Wildlife and Parks. Populations of these and other species may increase or decrease as a result of hunting and trapping activities.	These activities are managed by Montana Fish Wildlife and Parks
<b>Human Uses–Livestock</b>	Carcasses of grazing animals may become bear attractants. Grazing in riparian areas may decrease habitat quality if not managed properly. See table D-1, which also applies to aquatic and riparian wildlife species.	FW-DC-S&E-01 FW-DC-ECOS GR-01,02 FW-GDL-ECOS GR-03 FW-STD-ECOS GR-01 through 06 FW-GDL-ECOS GR-01 through 04
<b>Human Uses–Food, Garbage</b>	Human food and garbage may attract grizzly bears and other wildlife species, resulting in conflicts.	FW-STD-WL-02 FW-GDL-WL-01 through 04 FW-OBJ-REC-02 FW-STD-ECOS E&M-03,04,05